



*California Environmental Protection Agency*

# **AIR RESOURCES BOARD**

AIR QUALITY SURVEILLANCE BRANCH

STANDARD OPERATING PROCEDURES

FOR

**YOKOGAWA ELECTRIC CORPORATION  
MODEL DR – 240  
HYBRID CHART RECORDER**

AQSB SOP 604

First Edition

MONITORING AND LABORATORY DIVISION

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### Approval of Standard Operating Procedures (SOP)

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## **1.0 GENERAL INFORMATION**

### **1.1 Introduction:**

The purpose of these Standard Operating Procedures (SOP) is to supplement the manufacturer's Instruction Manual for the Yokogawa Hybrid Recorder DR-240 by documenting procedures that have been implemented by the Air Quality Surveillance Branch (AQSB) of the Air Resources Board (ARB). These procedures are designed to standardize installation, configuration and operational procedures and to insure comparability of all Yokogawa DR240 recorders. Additionally, this SOP describes any supplemental information or modifications to the recorder necessary to integrate it into California Air Resources Board's air monitoring network. As this document is supplemental to the Instruction Manual provided by the manufacturer, the ARB recommends a thorough review of the Yokogawa DR240 Instruction Manual.

### **1.2 Principle of Operation:**

The Yokogawa DR240 Hybrid Recorder is a multi-point strip chart recorder that provides a continuous, permanent record of ambient air quality data from ambient air quality monitoring instrumentation. The recorder can be configured to record multiple channels, and is capable of recording in 10 different colors. The AQSB typically configures its DR-240's to record either 10 or 20 channels. Input voltages range from -0.2V to +1.2V.

For complete specifications of the recorder refer to the section titled "Specifications" of the Instruction Manual.

### **1.3 Safety Precautions:**

Installation, operation, and maintenance of the recorder should only be performed by properly trained personnel. High (120 volts A.C.) voltages are used to power the unit. As with all monitoring equipment, precaution should be taken when working around electricity, power tools, and above ground elevations.

## **2.0 INSTALLATION PROCEDURE**

### **2.1 Physical Inspection:**

Inventory all the parts noted in the shipping document. Check for any shipping damage and incorrect or damaged parts or sub-assemblies. Assemble all parts as necessary for proper operation. Remove chart paper tray, raise display assembly and inspect inside the cabinet for loose parts or hardware or any loose or frayed wires or connectors. Check for correct main power cord phasing according to safe electrical code procedures. Ensure that all peripheral parts and cables ordered are included with the recorder.

### **2.2 Siting:**

The DR-240 recorder is designed to be mounted in a standard 19" equipment rack. The equipment rack should be mounted allowing enough clearance to open the front door of the recorder and to allow easy access to the rear panel terminal connections.

### **2.3 Mounting:**

Using eight(8) 10-32 self-tapping screws, mount the DR-240 to the rack.

### **2.4 Chart and Ribbon Cassette Installation:**

Install the ribbon cassette according to the procedures referenced in the Section 3.3, "Installing the Chart and Ribbon Cassette" of the DR-240 Instruction Manual. The chart paper is also installed according to the Section 3.3, "Installing the Chart and Ribbon Cassette" of the Instruction Manual with the following addition: the time stamp must line up properly with the chart paper. To achieve this, place the spot on the paper that corresponds to the current time and the top of the roller. At the start of the next hour re-check the paper to be sure the time hack lines up with the start of the hour. The "Feed" button on the front operational panel advances the point where chart markings are made on the chart paper. One package of chart paper should last approximately 50 days.

2.5 Instrument Connections:

Connect the instrument signal wires (18 gauge) from the instruments to the terminal blocks on the rear panel of the DR-240. The standard 10 and 20 channel AQSB chart configurations are listed in Tables 1 and 2. Additional detail is given in Section 3.5, "Connecting the Signal Lines" of the DR-240 Instruction Manual.

2.6 Power Connection, Power On/Off:

Connect the power and turn the recorder on according to the Section 3.6, "Connecting the Power Cable and Turning the Power ON/OFF" of the DR-240 Instruction Manual.

ARB Standard 20 Channel Stripchart Recorder Configuration (TABLE 1)

Pollutant/Parameter	Chart Channel	Chart Color	Chart Range (V)	Chart Range Units
Ozone (O3)	1	Light Green	0 to 1	0 – 500 ppb
Total Oxides of Nitrogen (NOx)	2	Red	0 to 1	0 – 1000 ppb
Nitric Oxide (NO)	3	Black	0 to 1	0 – 1000 ppb
Nitrogen Dioxide (NO2)	4	Light Blue	0 to 1	0 – 1000 ppb
Carbon Monoxide (CO)	5	Red	1 to 0 *	0 – 50 ppm
PM25 (BAM)	6	Brown	1 to 0 *	0 – 1000 ug/m3
Total Hydrocarbons (THC)	7	Dark Green	1 to 0 *	0 - 5 ppm
Methane (CH4)	8	Brown	0 to 1	0 - 5 ppm
Non-Methane Hydrocarbons (NMHC)	9	Violet	1 to 0 *	0 - 2 ppm
Sulfur Dioxide (SO2)	10	Purple	1 to 0 *	0 – 500 ppb
Coefficient of Haze (COH)	11	Black	0.2 to 1.2	0 – 20 COH10
Bscat (Nephelometer)	12	Orange	0 to 1	0 – 400bscatx10
User Defined	13			
Outside Temperature (OT)	14	Light Blue	1 to 0 *	-50 to +50 C
Inside Temperature (IT)	15	Dark Blue	0 to 1	0 – 50 C
Relative Humidity (Rh)	16	Brown	0 to 1	0 – 100 %
Barometric Pressure (BP)	17	Violet	0 - 1	Variable
Solar Radiation (SoRad)	18			0 – 2000 W/m2
User Defined	19			
User Defined	20			

\* Stripchart scale reads right to left.



ARB Standard 10 Channel Stripchart Recorder Configuration (TABLE 2)

Pollutant/Parameter	Chart Channel	Chart Color	Chart Range V	Chart Range Units
Ozone (O3)	1	Light Green	0 to 1	0 - 500 ppb
Total Oxides of Nitrogen (NOx)	2	Red	0 to 1	0 - 1000 ppb
Nitric Oxide (NO)	3	Black	0 to 1	0 - 1000 ppb
Nitrogen Dioxide (NO2)	4	Light Blue	0 to 1	0 - 1000 ppb
Carbon Monoxide (CO)	5	Dark Green	1 to 0 *	0 – 50 ppm
PM25 (BAM)	6	Brown	1 to 0 *	0 – 1000 ug/m3
User Defined	7			
User Defined	8			
User Defined	9			
Sulfur Dioxide (SO2)	10	Purple	1 to 0 *	0 – 500 ppb

\* Stripchart scale reads right to left.

### **3.0 CONFIGURATION**

#### **3.1 Recorder Configuration:**

The procedure for configuring the recorder is detailed in Appendix A of this SOP. The ARB standard channel labels, ink colors and chart ranges are listed in Tables 1 & 2.

## **4.0 RECORDER VERIFICATION PROCEDURES**

### **4.1 Recorder Verification:**

For recorder verification, compare the stripchart trace against the instrument reading. The difference should be no greater than 1% of full scale.

## **5.0 ROUTINE SERVICE CHECKS**

### **5.1 General Information:**

See the Section 13.1, "Periodic Maintenance and Recommended Parts Replacement Period" of the DR-240 Instruction Manual for further routine service check information.

### **5.2 Daily Checks:**

1. Check to see if display and recorder are functioning properly.
2. Check chart printout for blurred faded or broken sections.
3. Check that chart paper is feeding correctly.

### **5.3 Weekly Checks:**

1. Verify that there is sufficient chart paper remaining until next weekly check or replace chart paper.

## **6.0 MAINTENANCE PROCEDURES**

### **6.1 General Information:**

See DR-240 Instruction Manual for more detailed information regarding recorder maintenance.

## **7.0 TROUBLESHOOTING**

### **7.1 General Information:**

Refer to the Section 13.3, "Trouble-shooting and Maintenance" in the DR-240 Instruction Manual to troubleshoot problems. Consult the MLD's repair facility technician or the manufacturer for additional problems.

## APPENDIX A

### YOKOGAWA DR-240 STRIPCHART RECORDER CONFIGURATION PROCEDURE

#### **To Set Chart Speed:** (Section 6.2, "Setting Chart Speed" of the DR-240 Instruction Manual)

Press **Chart** button.  
Select chart using **Up/Down**. Press **Enter**.  
Select **25 MM/H** ( 1 inch/hour) using **Up/Down** and **Left/Right**.  
Press **Enter**.  
Press **Display**.

#### **To Set Time and Date:** (Section 3.7, "Setting the Date and Time" of the DR-240 Instruction Manual)

Press **Chart** button.  
Select clock using **Up/Down**. Press **Enter**.  
Select date and time using **Up/Down** and **Left/Right**.  
Press **Enter**.  
Press **Display**.

#### **To Set Print Colors:** (Section 10.6, "Setting Recorder Colors" of the DR-240 Instruction Manual)

Turn off **Power** switch. Press **Display** and hold in.  
Turn on **Power** while holding in **Display** for approximately 10 seconds.  
Press **Up/Down** to select color and press **Enter**.  
Press **Left/Right** to underline channel number and **Up/Down** to change channels.  
Press **Left/Right** to underline color, **Up/Down** to change  
Press **Enter**.  
Press **Mode**, then **Up/Down** to select **End**  
Press **Enter**.  
Press **Up/Down** to select **Store**  
Press **Enter**.  
Repeat for other channels.

## APPENDIX A (cont.)

### YOKOGAWA DR-240 STRIPCHART RECORDER CONFIGURATION PROCEDURE

**To Set Voltage Range:** (Section 5.1, "Setting the Type of Input and Recording Span" of the DR-240 Instruction Manual)

Press **Range** and use **Left/Right** keys to select channel.  
Press **Up/Down** to change channels.  
Press **Left/Right** keys to underline parameter to right of colon, i.e. ski, volt, etc.  
Press **Up/Down** key to select volt.  
Press **Left/Right** keys to underline voltage  
Press **Enter**.  
Press **Left/Right** and **Up/Down** keys to select range (0 to 1 volts).  
Press **Enter** and press **Display**.

**To Label Channel:** (Section 6.4, "Setting Tag, Digital Printout and Manual Printout" of the DR-240 Instruction Manual)

Press **Set** and hold in approximately 5 seconds.  
Press **Up/Down** keys and select **Tag**  
Press **Enter**.  
Select channels using **Left/Right** and **Up/Down** keys.  
Press **Left/Right** keys to move cursor to right of **Tag =**.  
The alphabet will display at bottom of screen.  
Press **Up/Down** and **Left/Right** keys to select consecutive letters for print label  
(Example – Ozone)  
Press **Enter** and **Display**.



## APPENDIX A (cont.)

### YOKOGAWA DR-240 STRIPCHART RECORDER CONFIGURATION PROCEDURE

**To Print the Time Every Hour:** (Section 6.4, "Setting Tag, Digital Printout and Manual Printout" of the DR-240 Instruction Manual)

Press **Set** and hold in approximately 5 seconds.  
Press **Up/Down** to select "digital print" from the menu  
Press **Enter**.  
Press **Up/Down** and **Left/Right** key to select channel number.  
Press **Left/Right** keys to scroll to right of = on.  
Press **Enter**.  
Select channel **1** to \*\* (10 or 20).  
Press **Left/Right** keys to scroll cursor to off or on.  
Press **Up/Down** keys to select **Off**.  
Press **Enter**.  
Press **Display**.

**To Set Recording Format:** (Section 10.3, "Setting the Recording Format" of the DR-240 Instruction Manual)

Press **Power** switch to off.  
Press **Display** and hold while switching **Power** back on. When a menu appears, release **Display**.  
Press **Up/Down** keys to select **Record**  
Press **Enter**.  
Press **Up/Down** keys to select **Tag**  
Press **Enter**.  
Follow the instructions of the Instruction Manual. The only deviation from the procedure outlined in the Instruction manual is to set the "LOG INTERVAL" to "Multiple."  
Press **Enter**.  
Press **Mode** key once.  
Press **Up/Down** to **End**  
Press **Enter**.  
Press **Up/Down** to select **Store**  
Press **Enter**.

## APPENDIX A (cont.)

### YOKOGAWA DR-240 STRIPCHART RECORDER CONFIGURATION PROCEDURE

**To Skip Channels:** (Section 5.1, "Setting the Type of Input and Recording Span" of the DR-240 Instruction Manual)

Press **Range** key and select channels to skip, using **Left/Right** and **Up/Down** keys.  
Move cursor to right side of ":" using **Left/Right** keys.  
Select **Skip** using **Up/Down** keys  
Press **Enter**.  
Press **Display**.

**To Adjust Zero and Span:** (Section 10.1, "Selecting Adjustment of Dot-Printing Position or Scan Interval" of the DR-240 Instruction Manual)

Press **Power** switch to off.  
Press **Display** and hold while pressing **Power** back on.  
Release **Display** when menu appears.  
Press **Up/Down** keys and select **Print Adjust**.  
Printer Hys= center trace. Use **Up/Down** keys to set value (-50 - +50) and press **Enter**.  
Printer zero = left trace Use **Up/Down** keys to set value (1-500) and press **Enter**.  
Printer full = (right trace). Use **Up/Down** keys to set value (2400-2600) and press **Enter**.  
Press **Mode**.  
Press **Up/Down** keys to select **End**  
Press **Enter**.  
Press **Up/Down** keys to select **Store**  
Press **Enter**.

## APPENDIX A (cont.)

### YOKOGAWA DR-240 STRIPCHART RECORDER CONFIGURATION PROCEDURE

**To Set Printer Zone:** (Section 6.3, "Setting Recording Zones and Partially Expanded Recording" of the DR-240 Instruction Manual)

Press **Set** until menu appears.

Press **Up/Down** keys to select **Zone**

Press **Enter**.

Press **Up/Down** and **Left/Right** keys to select channel.

Press **Up/Down** and **Left/Right** keys to select zone **6-G 0/250/mm**.

Press **Enter** and press **Display**.